Simio with Optimization

Installation Document

Version: 2.0
Date: March 9th, 2022

Introduction

This document is meant to accompany a Simio simulation model that incorporates optimization to address decision making. In order to run the model, we will be using the following software:

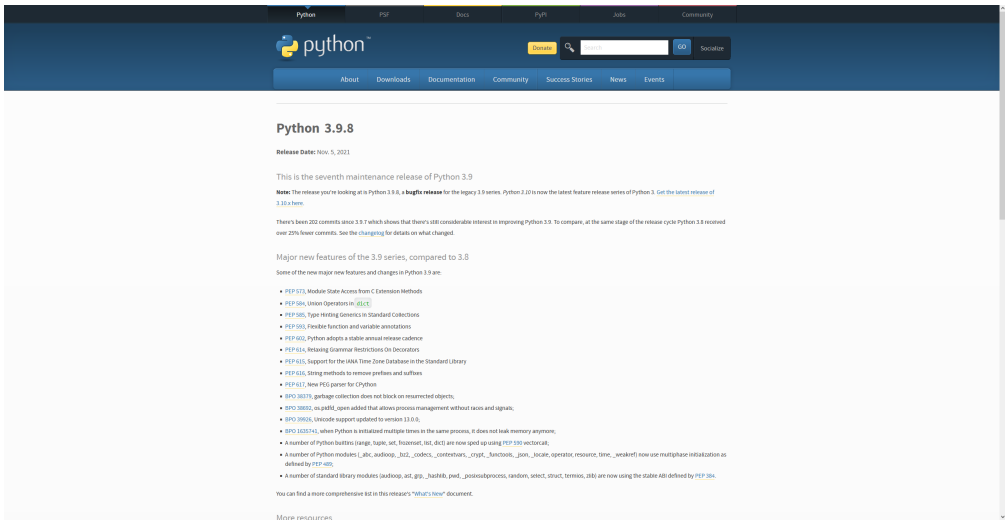
- Simio (v. 14)
- SQL Server 2019
- SQL Server Management Studio (v. 18)
- Python (v. 3.9.8)
- Gurobi (v. 9.5)

Additionally, the following files are included with this installation document and will be referenced:

- Simio Model (SupplyChainWithOptimization.spfx)
- Simio Custom Step (CallPython.dll)
- Python Script (SupplyChainWithOptimization.py)
- SQL Server Express Backup (SupplyChainWithOptimization.bak)

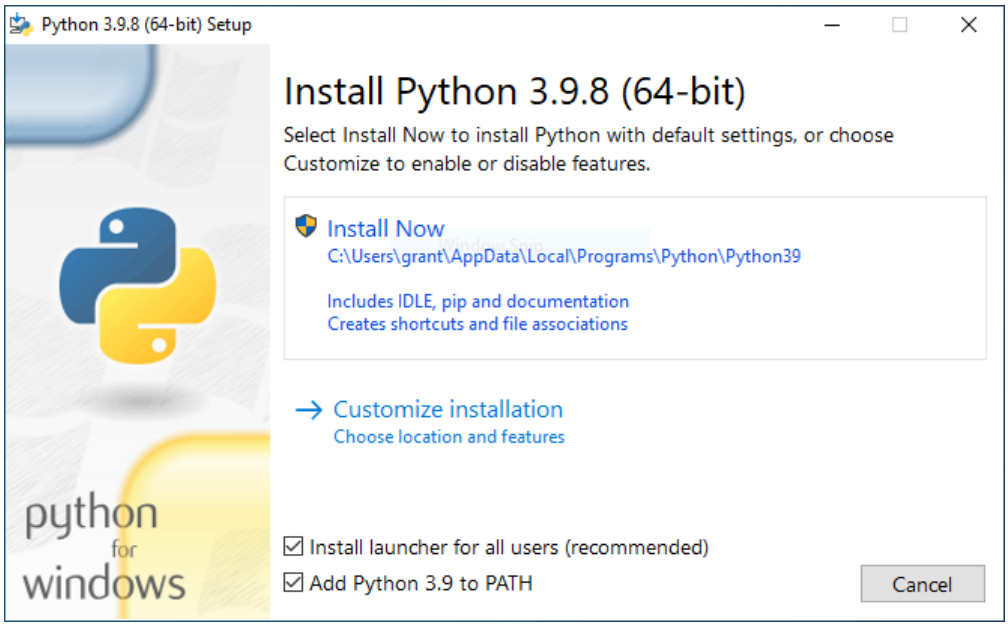
This document walks you through installing the software and then configuring and setting each up. If you feel comfortable with installing software, you can jump to the Setting Up Simio section.

Install Python



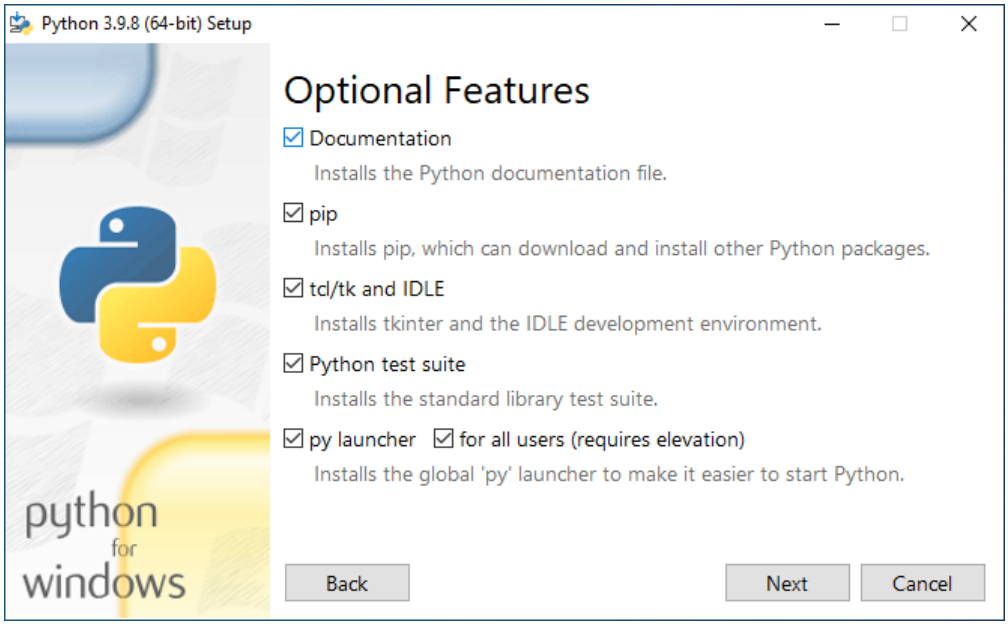
1. Go to the following link: https://www.python.org/downloads/release/python-398/
2. Download the "Windows installer (64-bit)" installer.

3. After the download, run the installer.



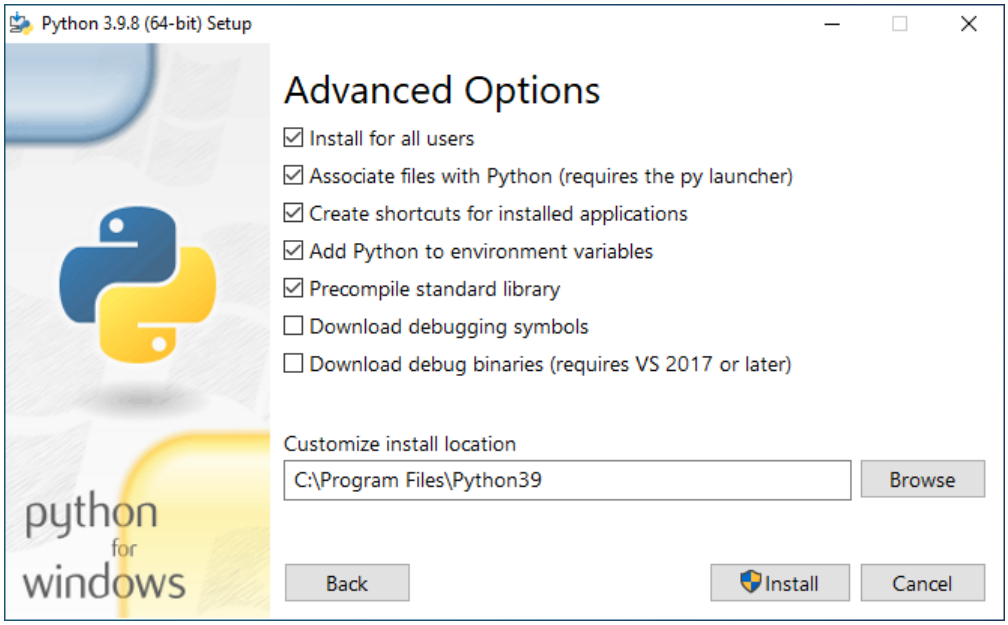
4. In the window that appears above, select "Add Python 3.9 to PATH."

5. Select "Customize installation."



6. In the next window, we will leave ALL Optional Features selected.

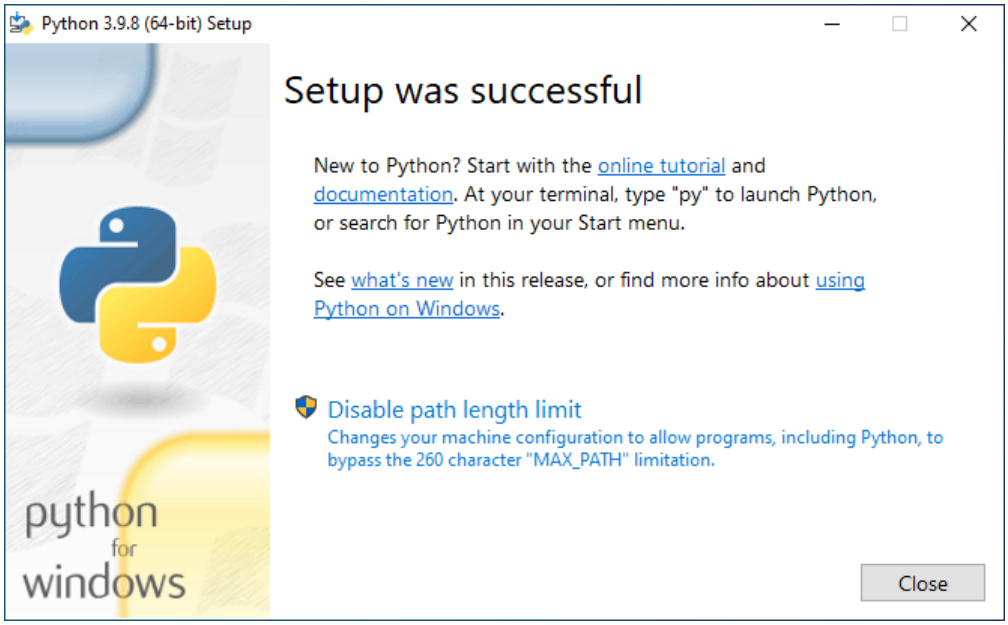
7. Select "Next."



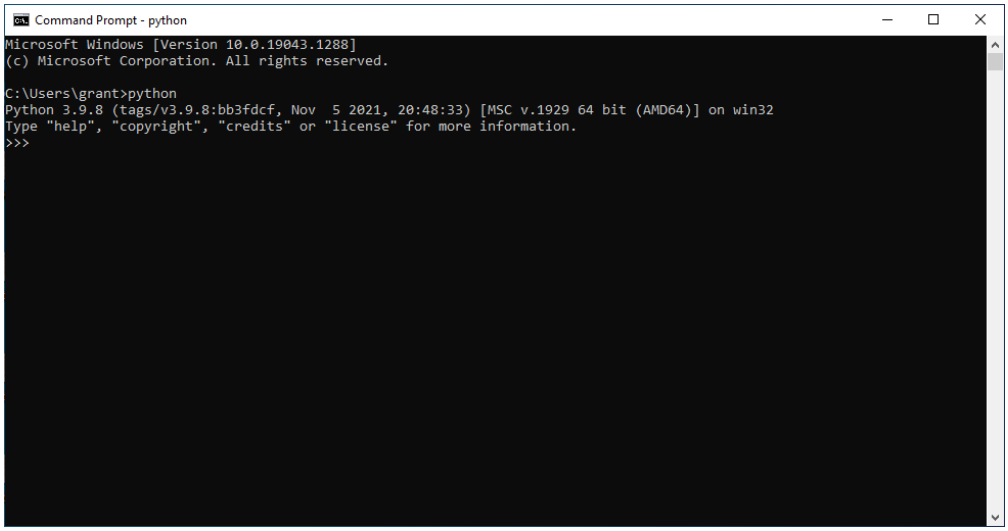
8. In the next window, select "Install for all users."

Note: We will use the default install location, however you can change it here.

9. Select "Install." Installation will begin.



10. Once installation is finished, Select "Close."



11. Now we can use Python. To confirm whether Python was properly added to your PATH variable, open a Command Prompt window.

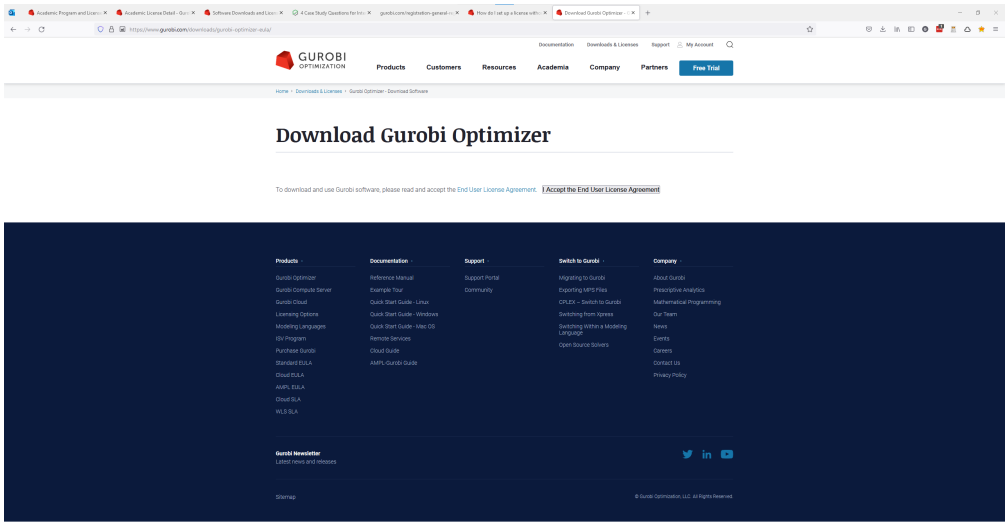
12. Type `python` and press "Enter". You should receive a response similar to the one in the picture above.

You are now ready to use Python.

Install Gurobi

1. You will need to create an account with Gurobi. Use the following link: https://pages.gurobi.com/registration

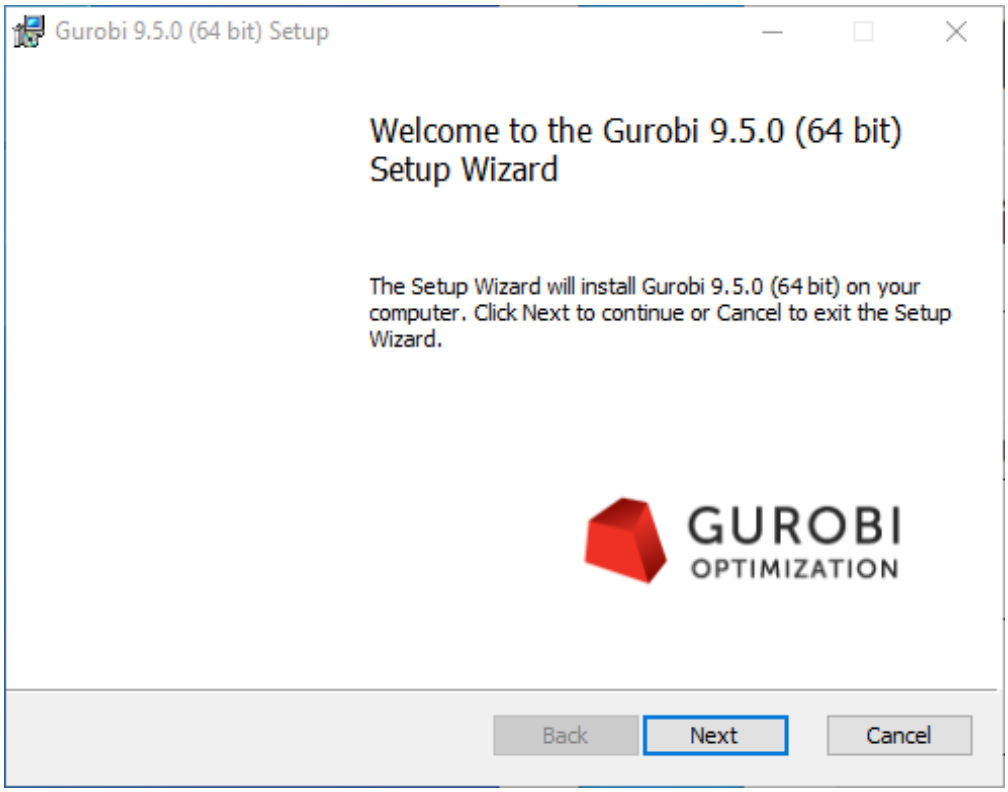
2. Once you are registered and logged in, Go to the following link: https://www.gurobi.com/downloads/gurobi-optimizer-eula/



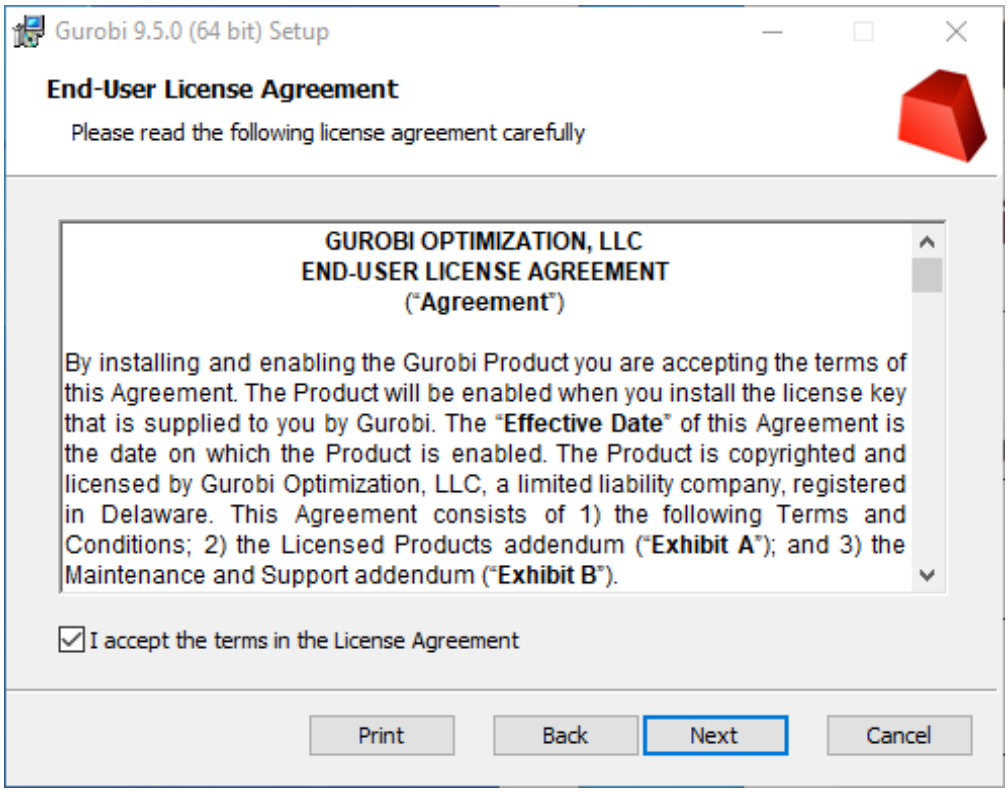
3. Select "I Accept the End User License Agreement."

4. Download the "Gurobi-9.5.0-win64.msi" installer.

5. After the download, run the installer.

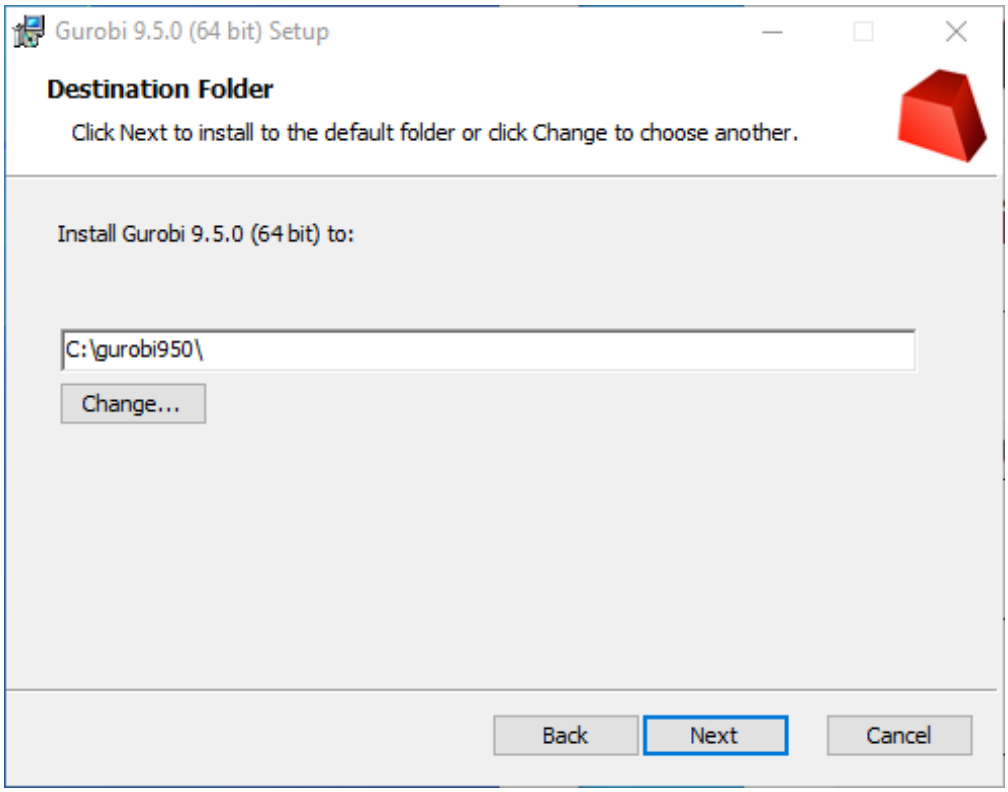


6. In the window that appears above, select "Next."



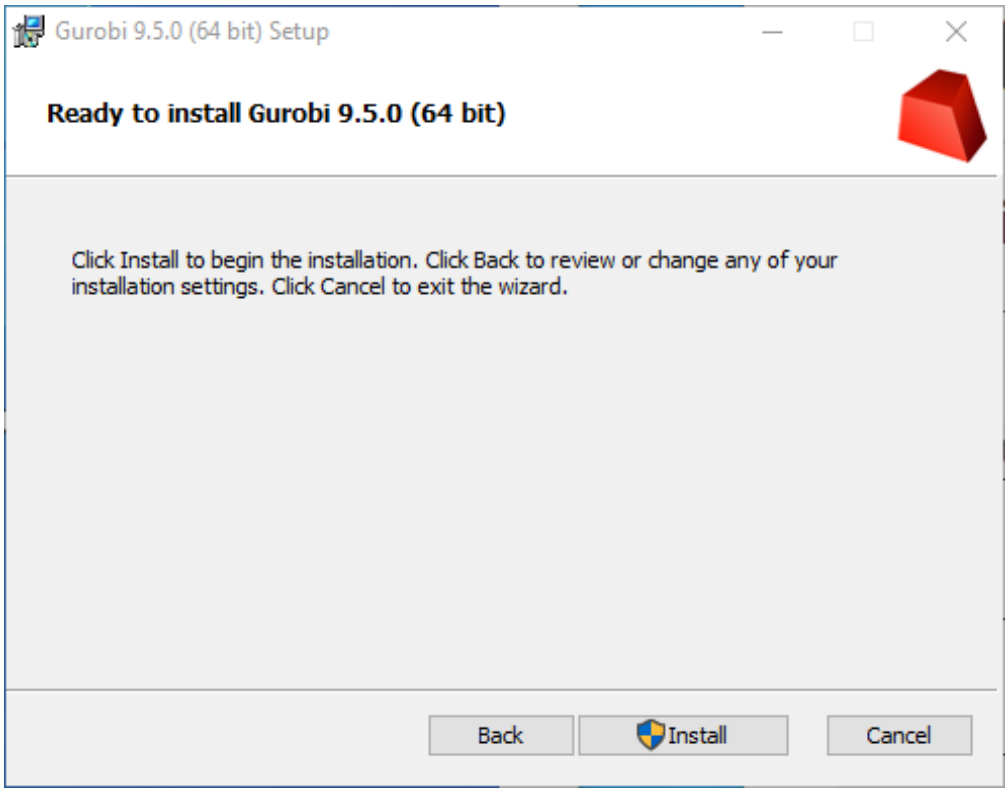
7. In the next window, select "I accept the terms in the License Agreement."

8. Select "Next."

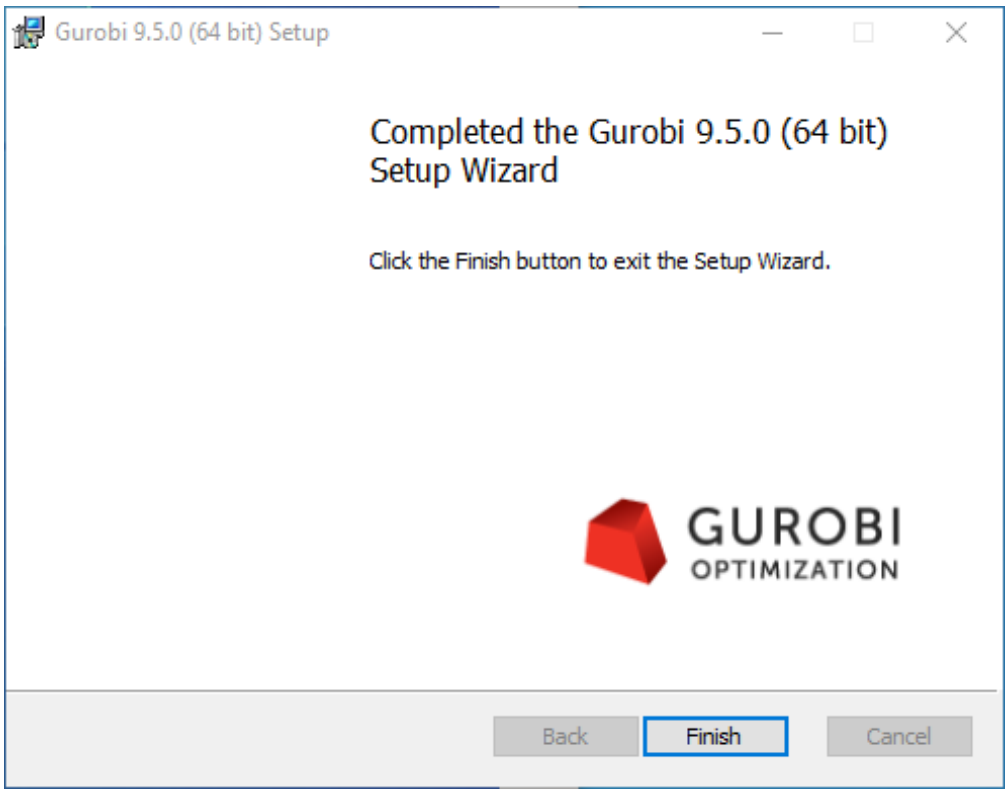


9. In the next window, select "Next."

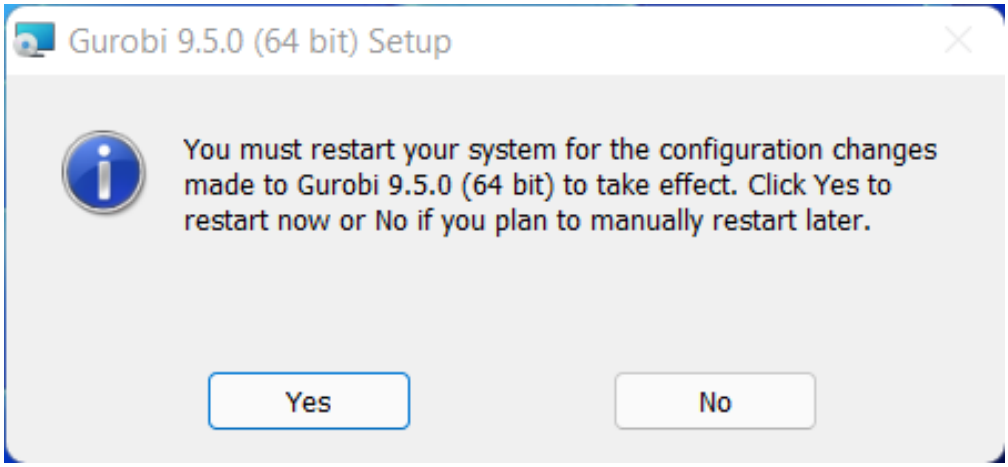
Note: We will use the default install location, however you can change it here.



10. In the next window, select "Install." Installation will begin.



11. Once installation is finished, select "Finish."

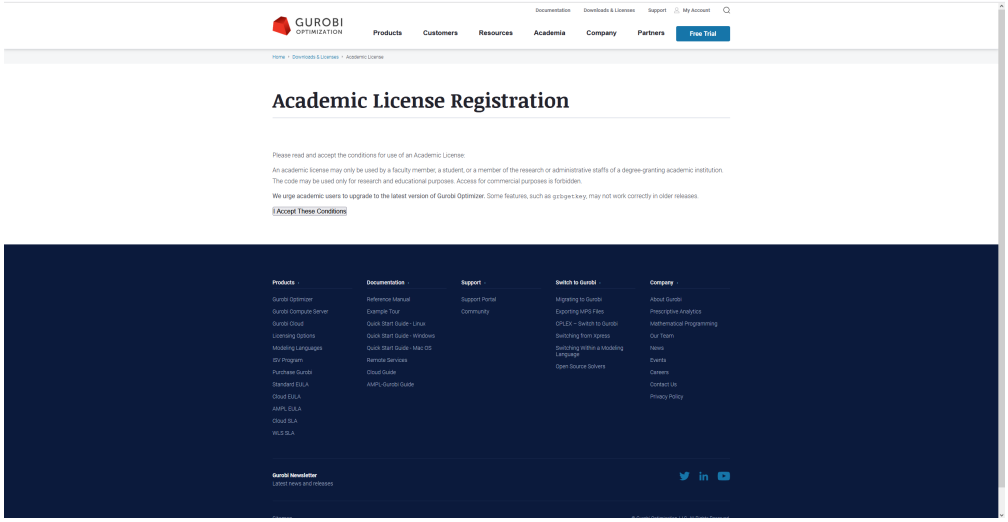


12. You will need to restart your computer. Select "Yes."

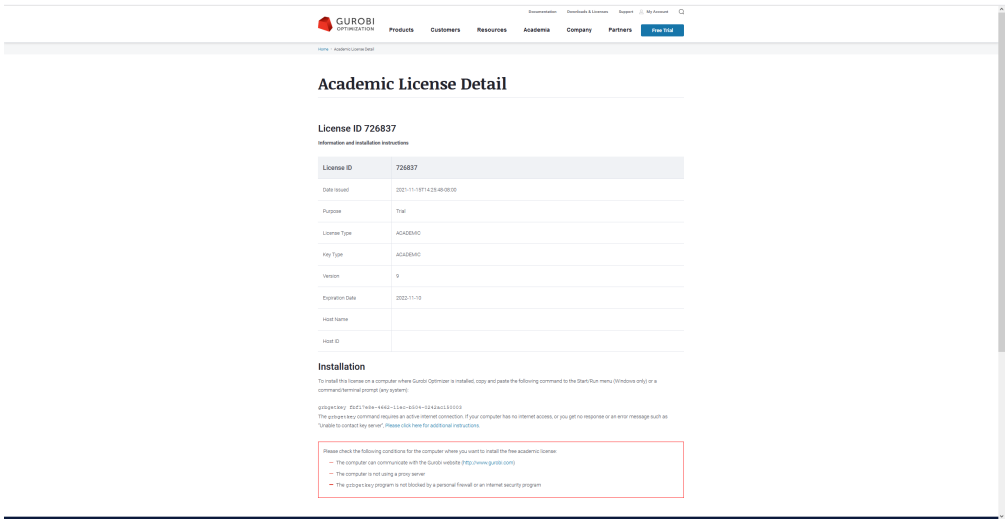
Before we can use Gurobi, we must request a license and install it.

Note: These instructions will be for an Academic license, but are similar for all license types. When installing an Academic license, the computer must be connected to your school's network for verification.

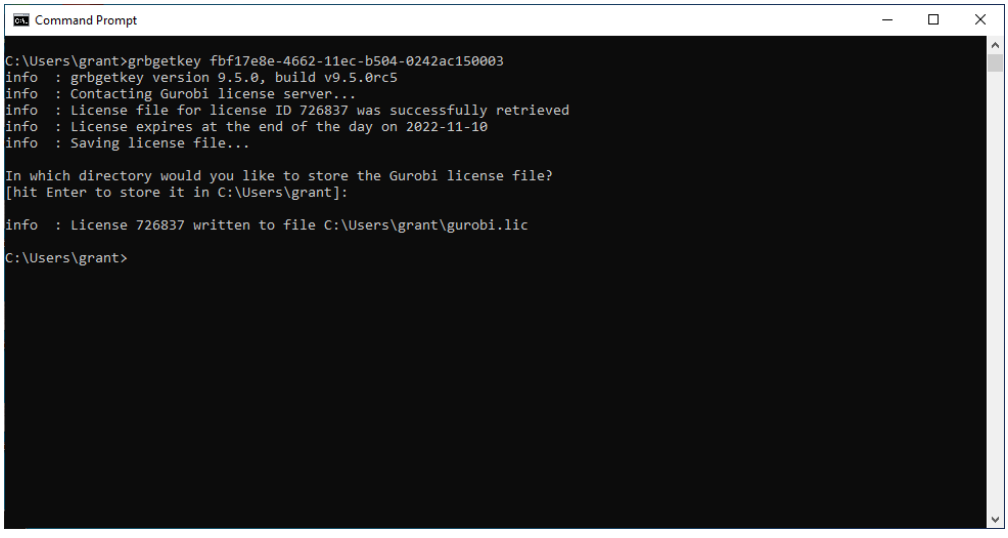
13. Go to the following link: https://www.gurobi.com/downloads/end-user-license-agreement-academic/



14. Select "I Accept These Conditions"



15. On the following page, you will see a command under the "Installation" section with the structure `grbgetkey LICENSE` where `LICENSE` is your unique license. Copy that string.



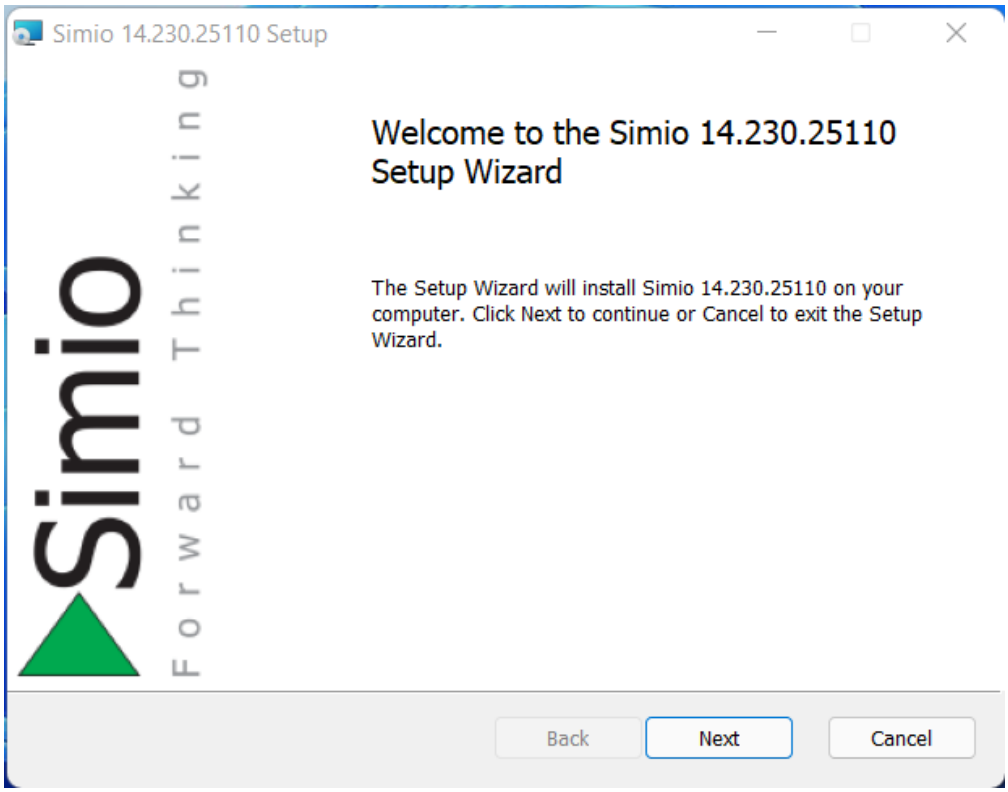
15. Open a Command Prompt.
16. Paste the `grbgetkey LICENSE` command and press "Enter." During the installation process, it will ask you to press `Enter` to store the license in the default directory. It is recommended that you do this.

You are now ready to use Gurobi.

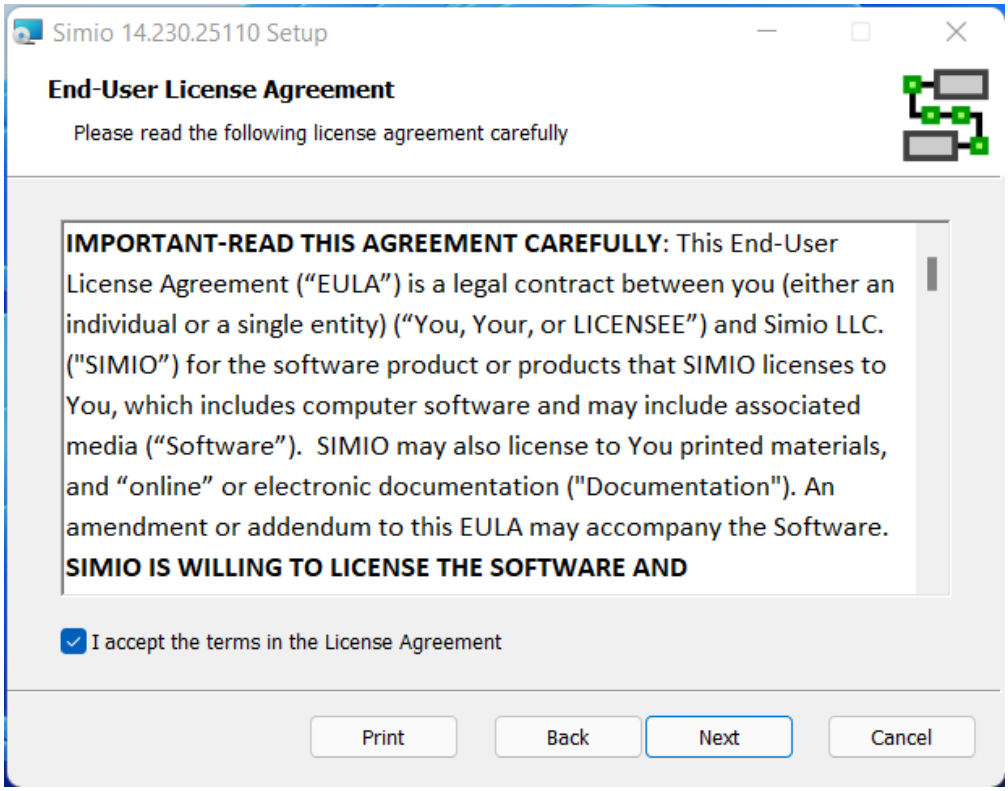
Install Simio

Using Simio requires obtaining the software and a license. For these instructions, it will be assumed that you have already obtained the installer. Also, given the multiple methods of licensing Simio, it will not be covered here.

1. Run the installer.

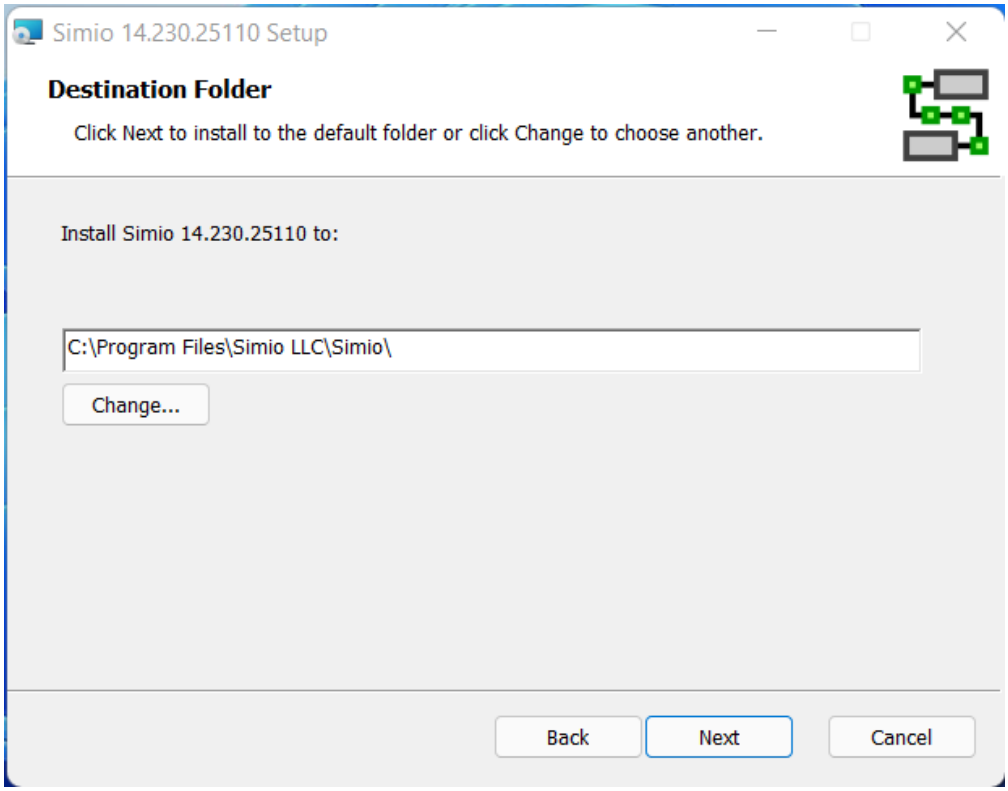


2. In the window that appears above, select "Next."



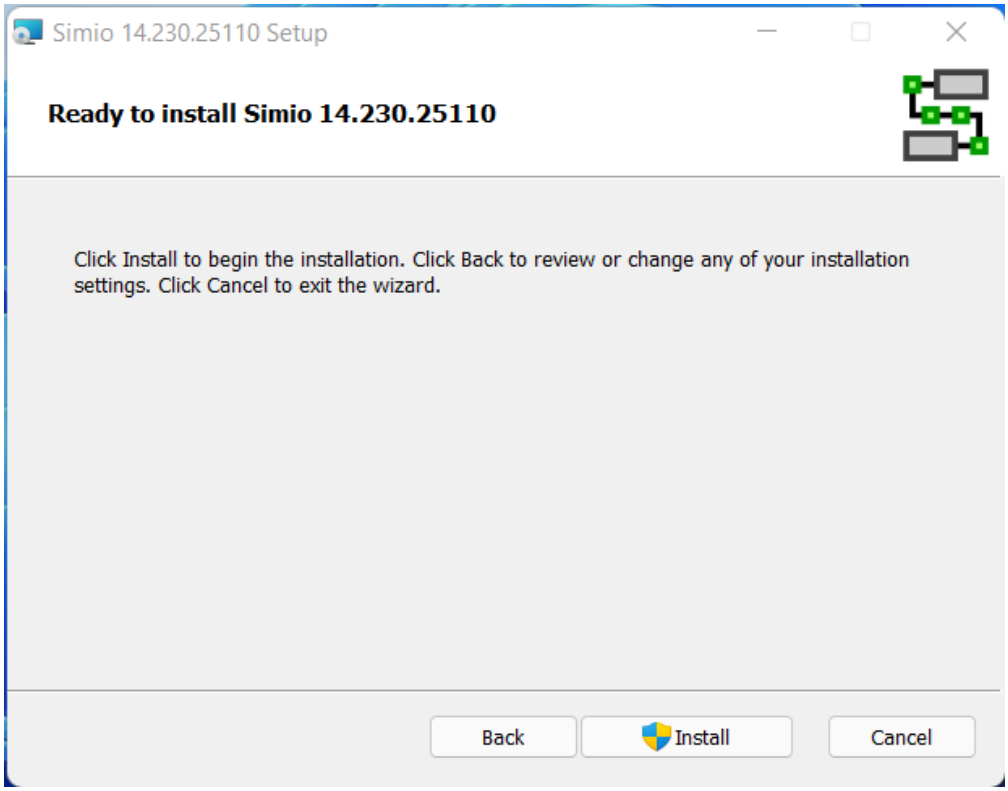
3. In the next window, select "I accept the terms in the License Agreement."

4. Select "Next."

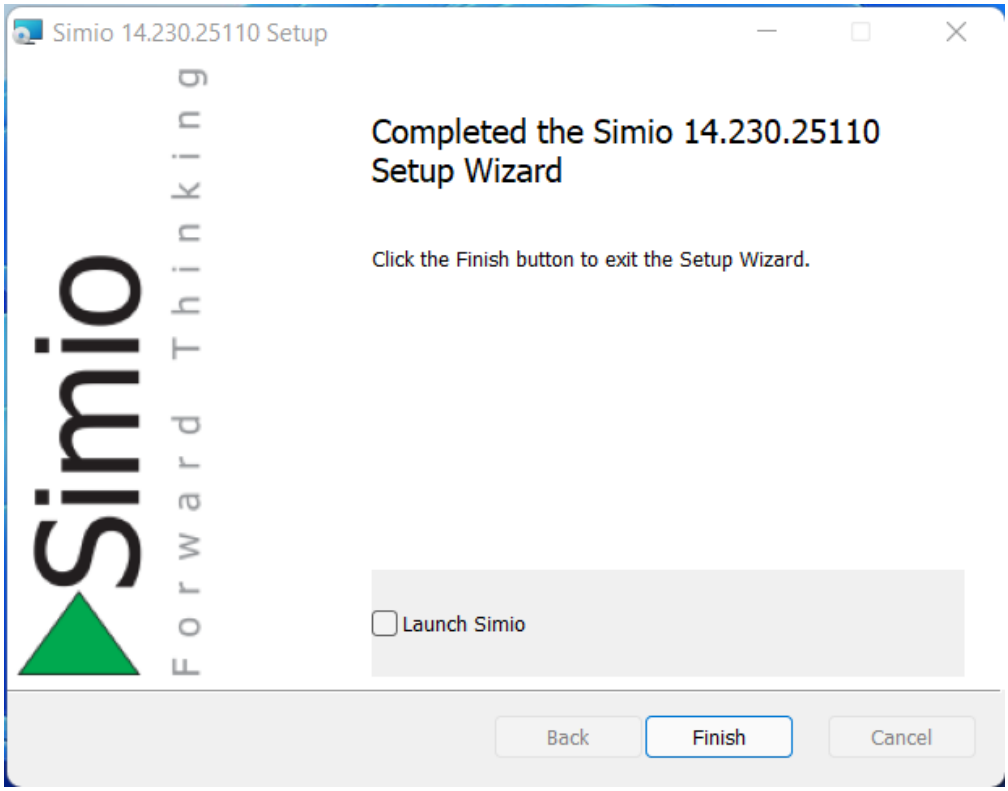


5. In the next window, select "Next."

Note: We will use the default install location, however you can change it here.



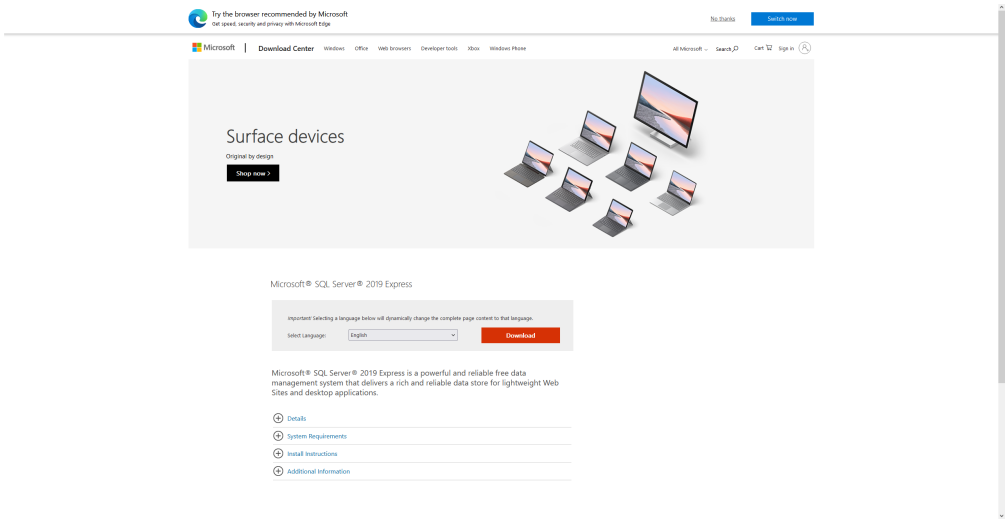
6. In the next window, select "Install." Installation will begin.



7. Once installation is finished, select "Finish."

You are now ready to use Simio.

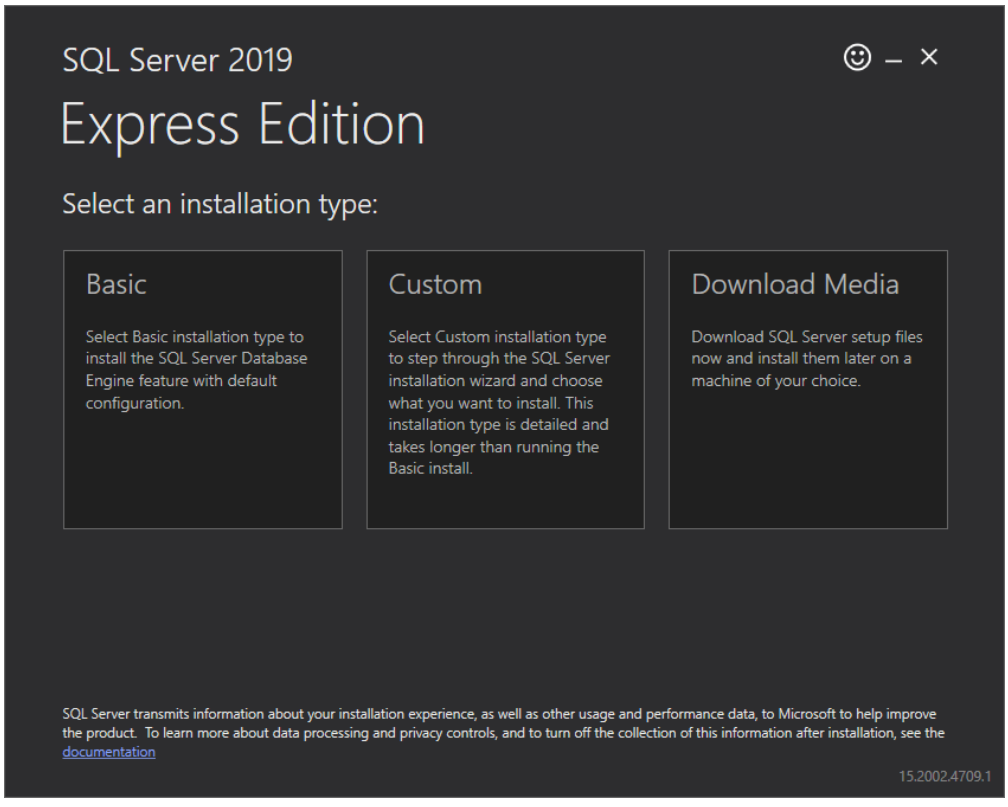
Install SQL Server Express



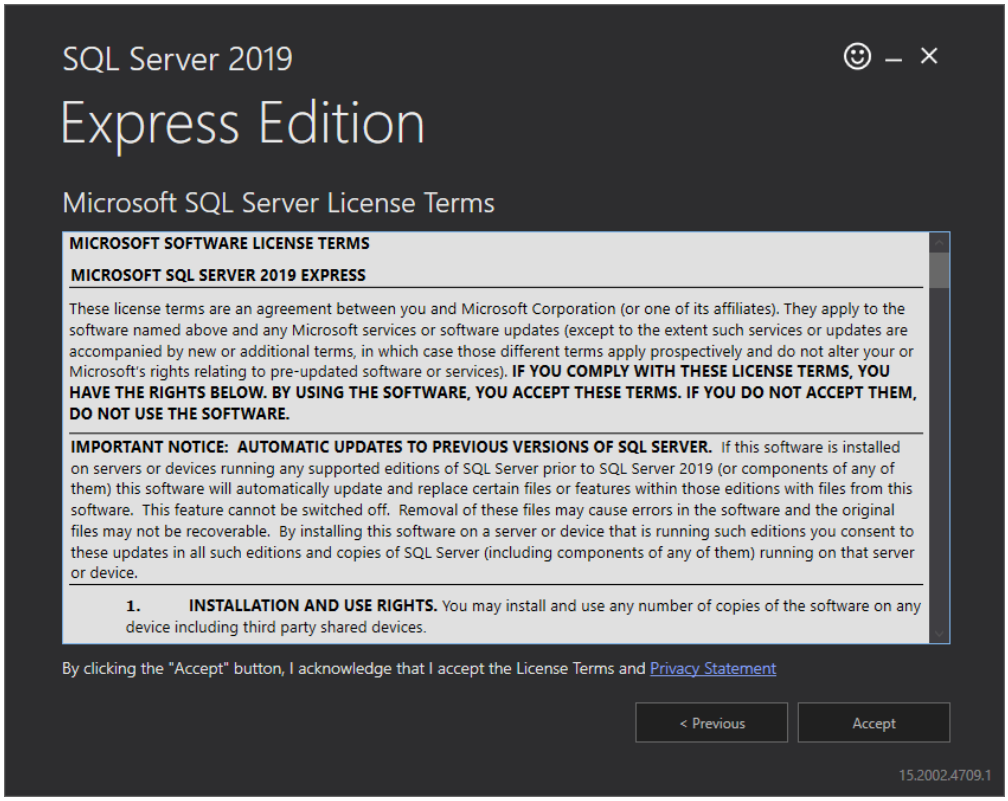
1. Go to the following link: https://www.microsoft.com/en-us/download/details.aspx?id=101064

2. Select "Download"

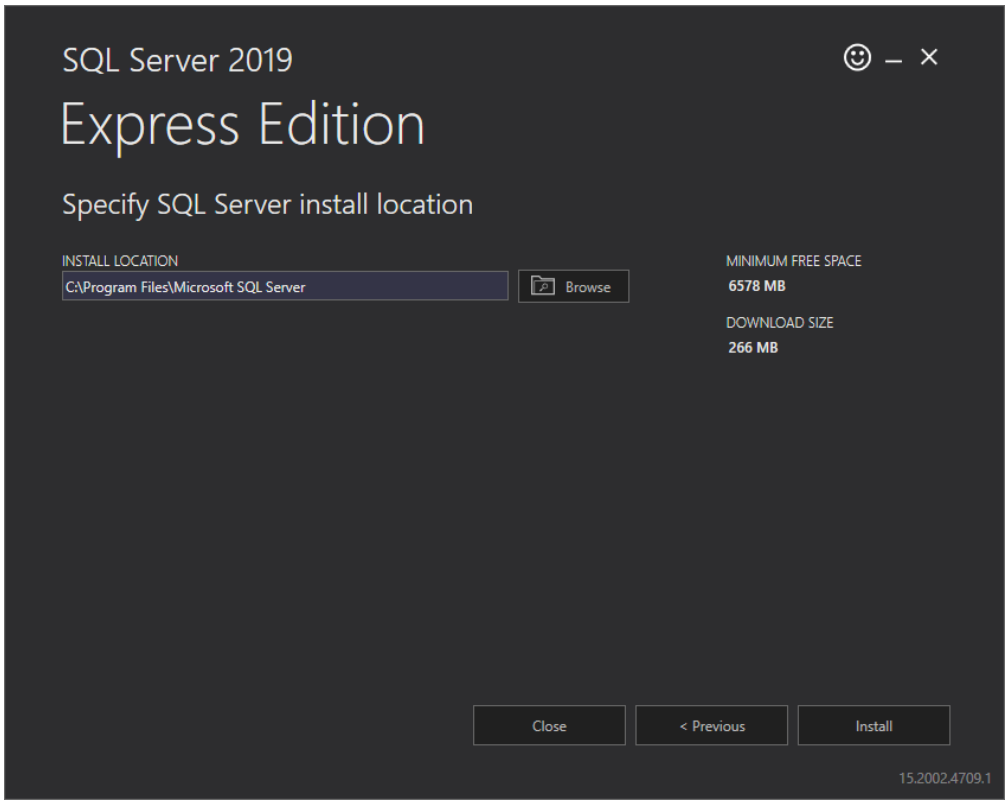
3. After the download, run the installer.



4. In the window that appears above, select "Basic."

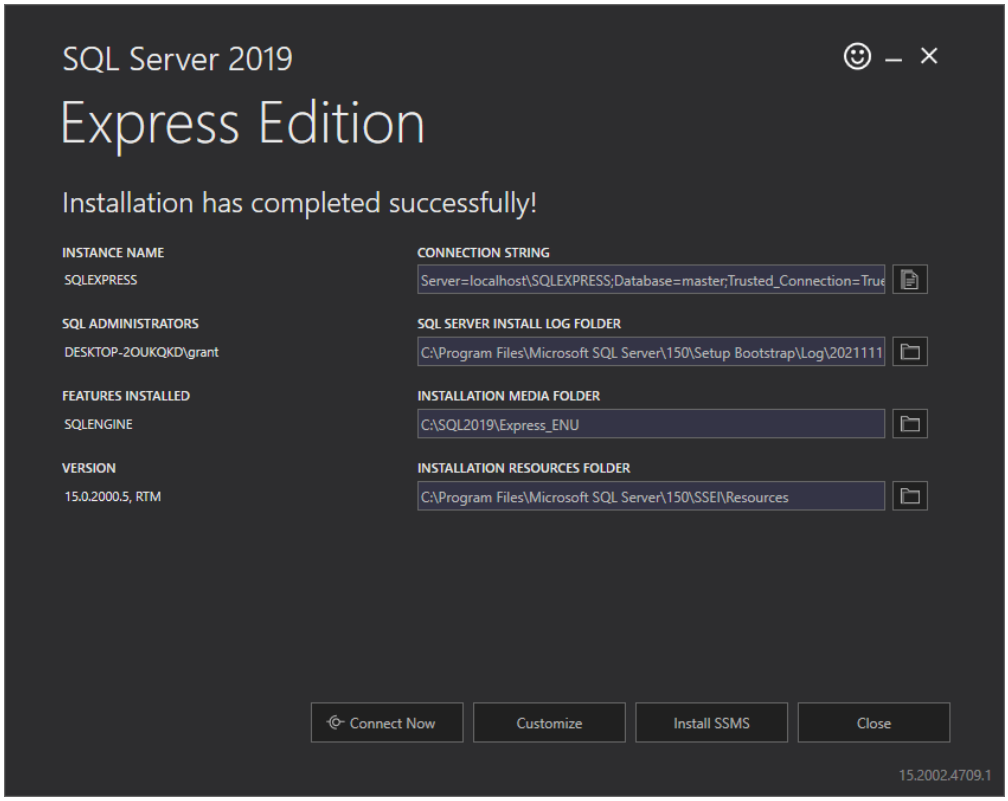


5. In the next window, select "Accept."



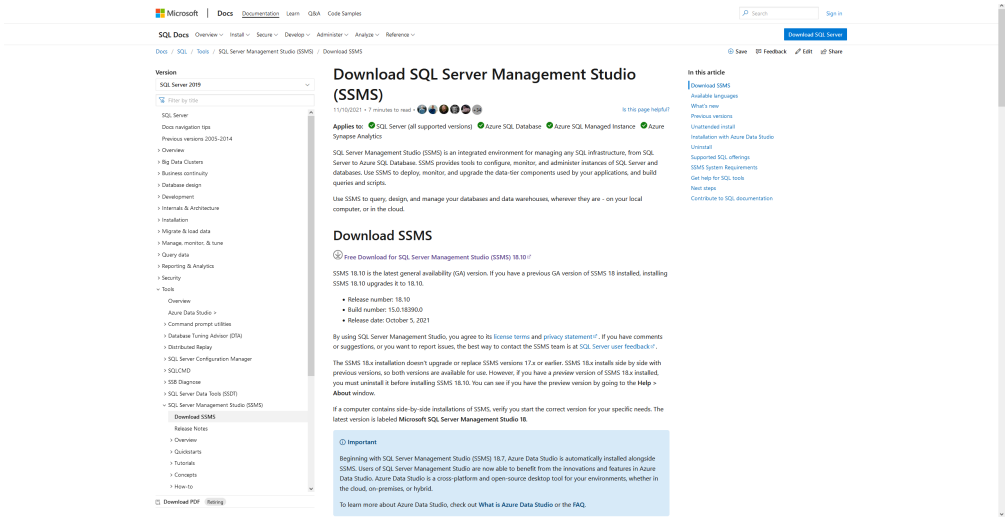
6. In the next window, select "Install." Installation will begin.

Note: We will use the default install location, however you can change it here.

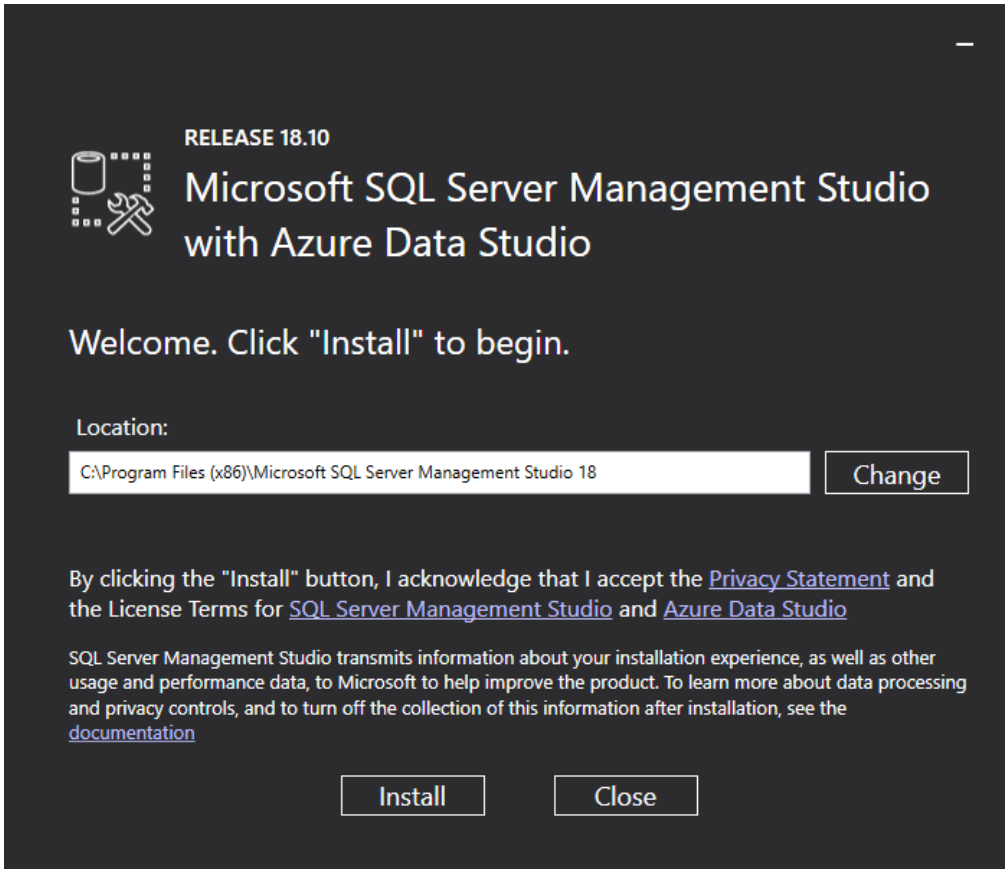


10. Once installation is finished, Select "Close."

Install SQL Server Management Studio

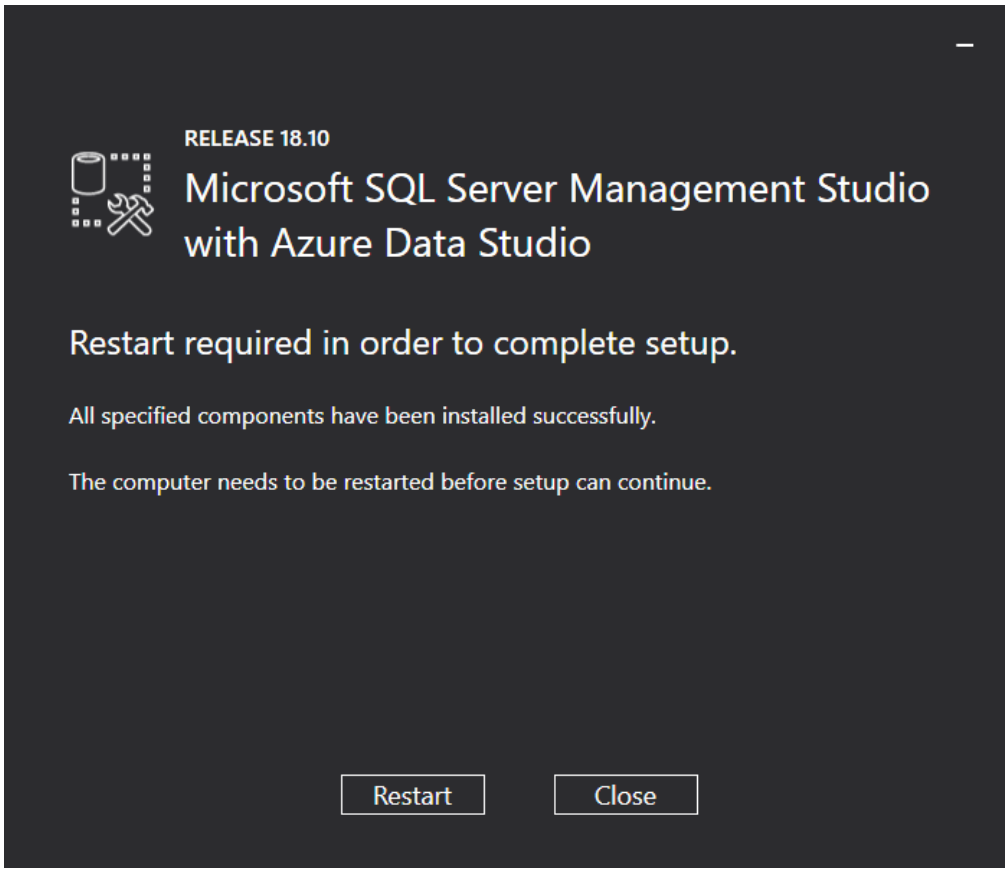


1. Go to the following link: https://docs.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms?view=sql-server-ver15
2. Download the "SQL Server Management Studio (SSMS) 18.10" installer.
3. After the download, run the installer.



4. In the window that appears above, select "Install."

Note: We will use the default install location, however you can change it here.



5. In the next window, select "Restart."

Configuring Simio

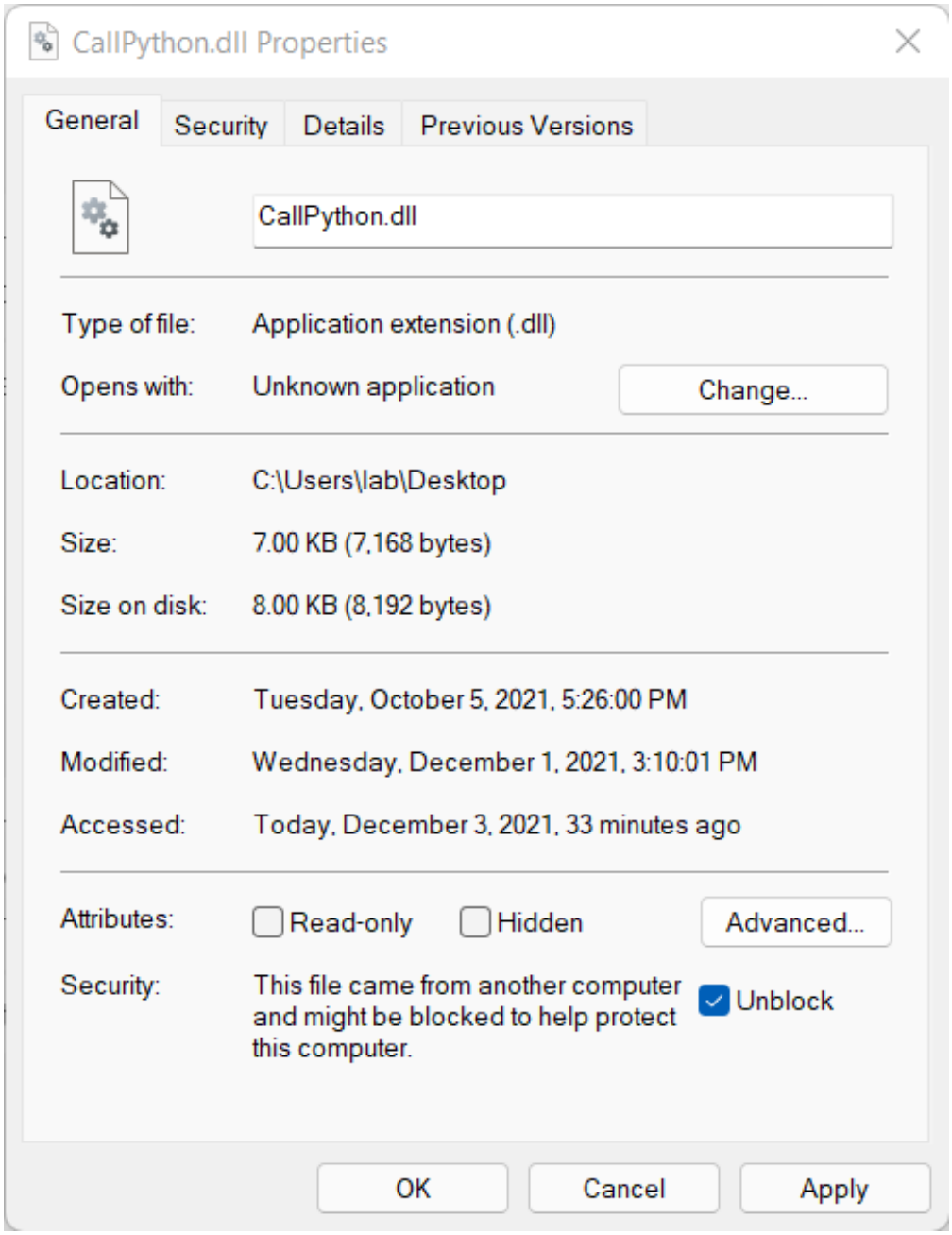
In order for Simio to interact with Python, a custom step named "CallPython" must be installed. This must be done before opening the model file.

1. Locate the following folder: "C:\Program Files\Simio LLC\Simio\UserExtensions".

Note: This assumes that you used the default installation location when installing Simio.

2. Create a Folder named "CallPython."

3. Place the "CallPython.dll" file in the newly created folder.

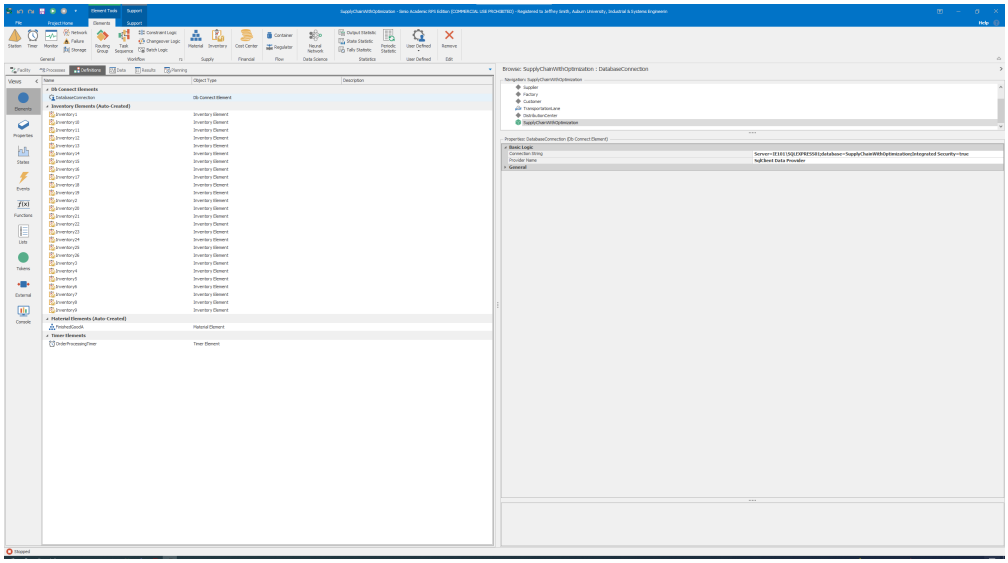


4. Right-Click on the "CallPython.dll" file and select "Properties."
5. Under Security, check the "Unblock" box.
6. Select "Apply" and close the "Properties" window.

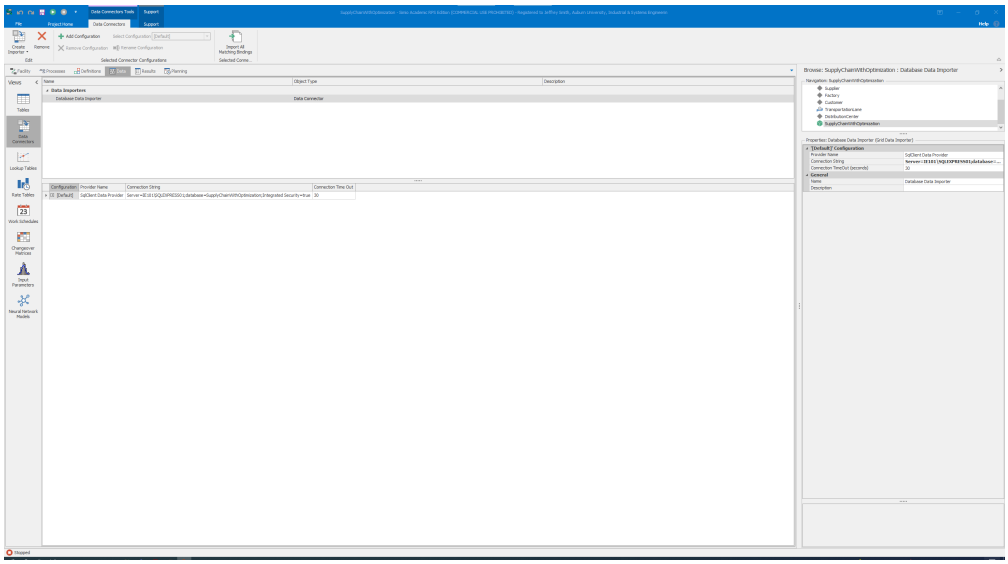
The "CallPython" step is ready to be used by Simio.

For Simio to interact with the SQL Server Express database:

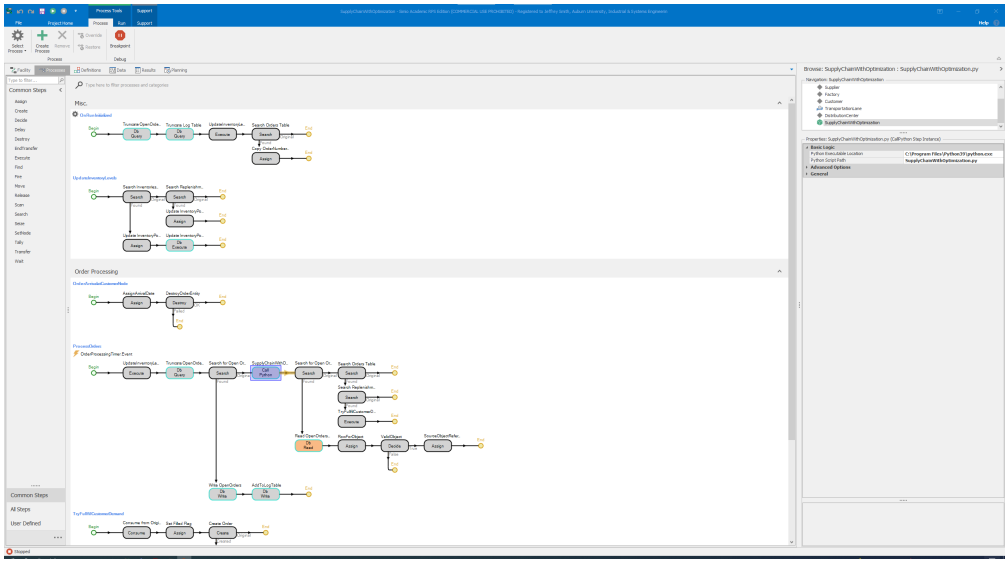
4. Open the Simio Model.



5. Navigate to Elements tab in the Definitions window.
6. In the Properties of the "DatabaseConnection" element, edit the Connection String to include your SQL Server Express server's name. Ex: "Server=<SERVERNAME>; database=SupplyChainWithOptimization; Integrated Security =true"



7. Navigate to the Data Connectors tab in the Data window.
8. In the Properties of the "Database Data Importer" object, edit the Connection String to include your SQL Server Express server's name. Ex: "Server=<SERVERNAME>; database=SupplyChainWithOptimization; Integrated Security =true"



For Simio to interact with Python:

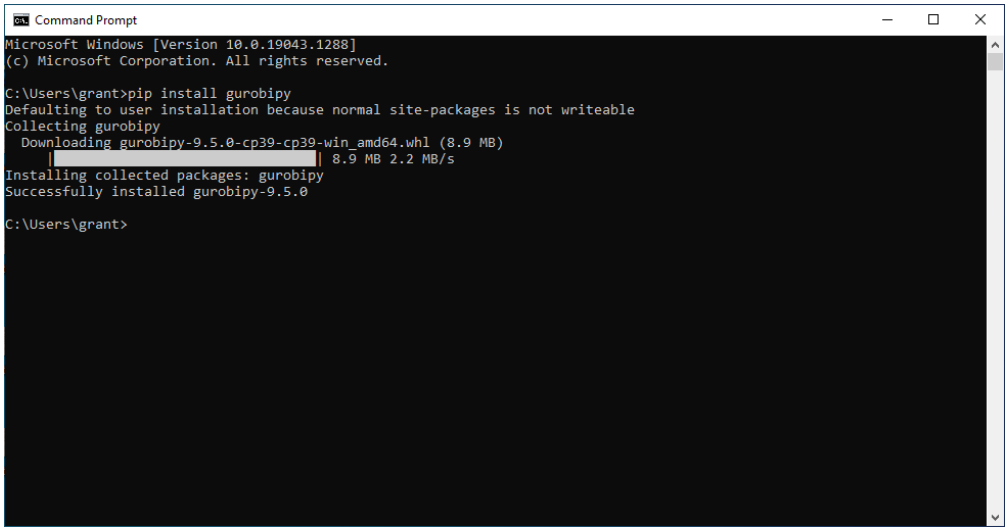
9. Locate the "CallPython" step in the "ProcessOrders" user-defined process.
10. Update the following properties of the "CallPython" step:
    - Python Executable Location: C:\Program Files\Python39\python.exe
    - Python Script Path: SupplyChainWithOptimization.py

Note: This assumes that you used the default installation location when installing Python.

11. The Simio model is configured. Save the model.

Setting Up Python

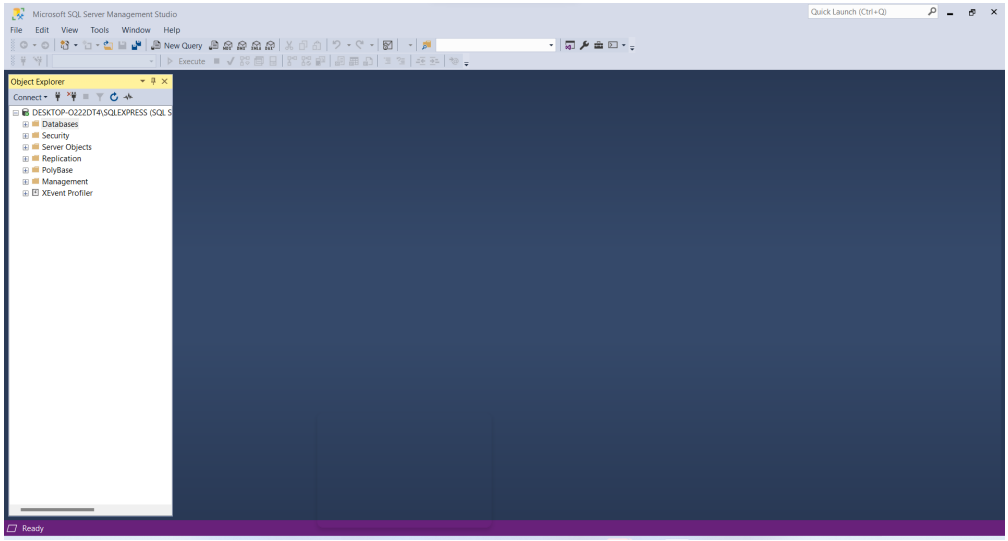
In order for Python to interact with Gurobi, we will be utilizing the `gurobipy` Python package.



1. Open a Command Prompt window. Type `pip install gurobipy`. Pip is a package manager for Python and it will locate and download the `gurobipy` package.

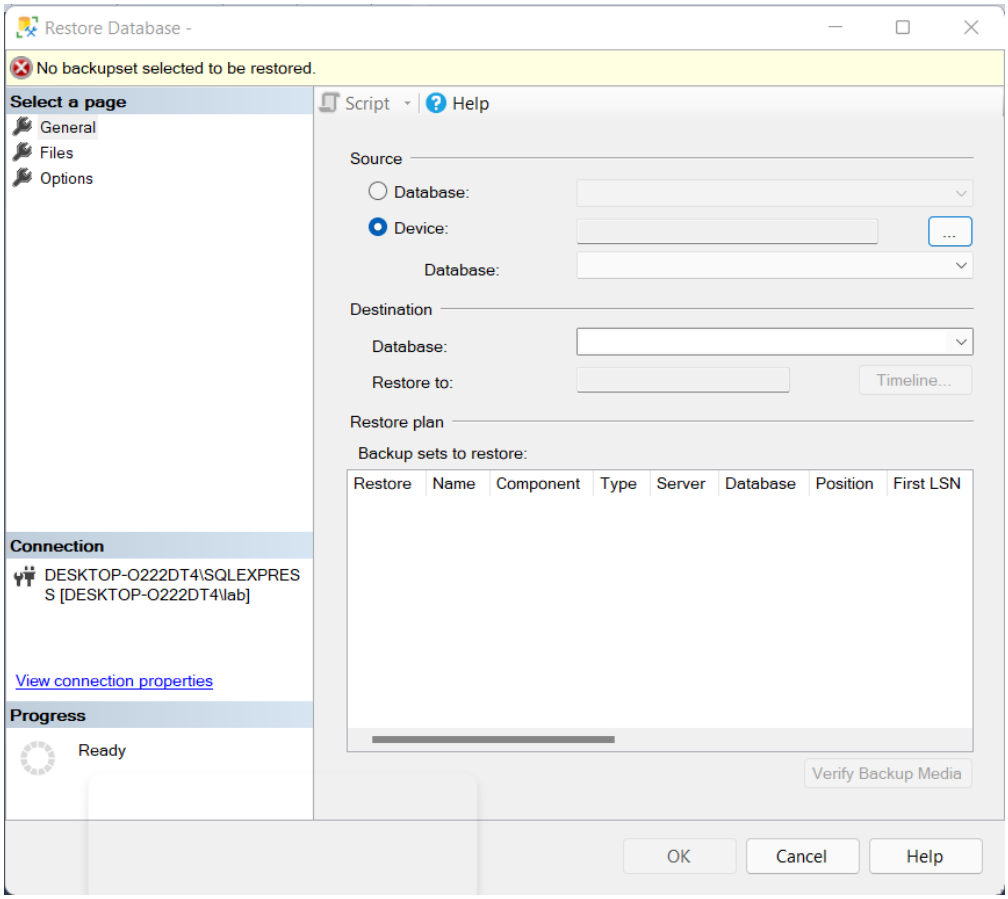
2. Repeat the same process to install the `numpy`, `pandas`, `pyodbc` python packages.

Setting Up SQL Server Express



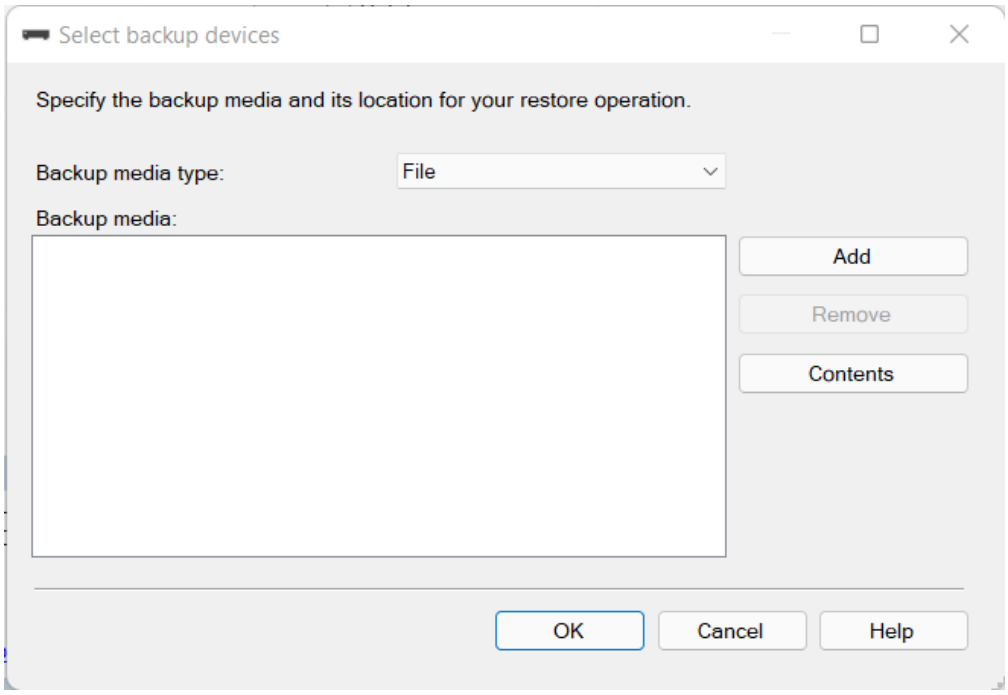
The SupplyChain database needs to be restored. We will use SQL Server Management Studio to interact with SQL Server Express.

1. Right-Click on "Databases" in the Object Explorer and select "Restore Database..."



2. On the "General" page, use the "Source" section to specify the source and location of the backup sets to restore. Select "Device."

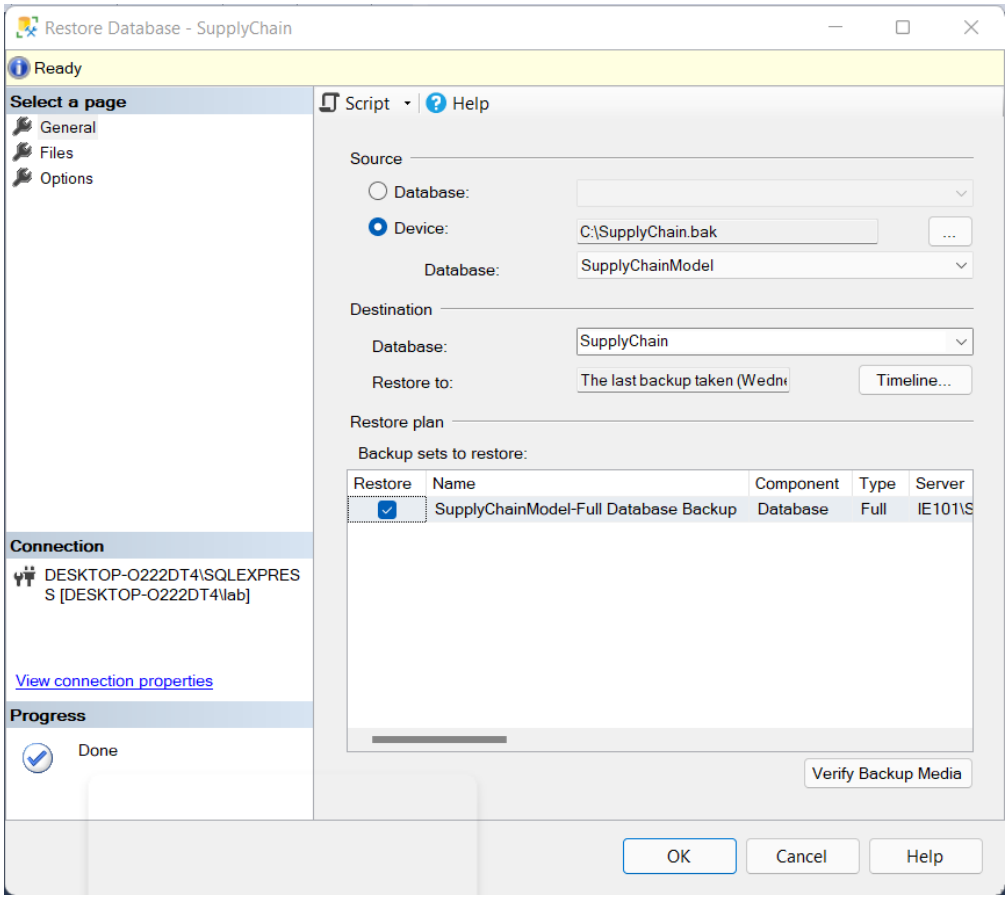
3. Click the browse (...) button to open the "Select backup devices" dialog box.



4. Select "Add."

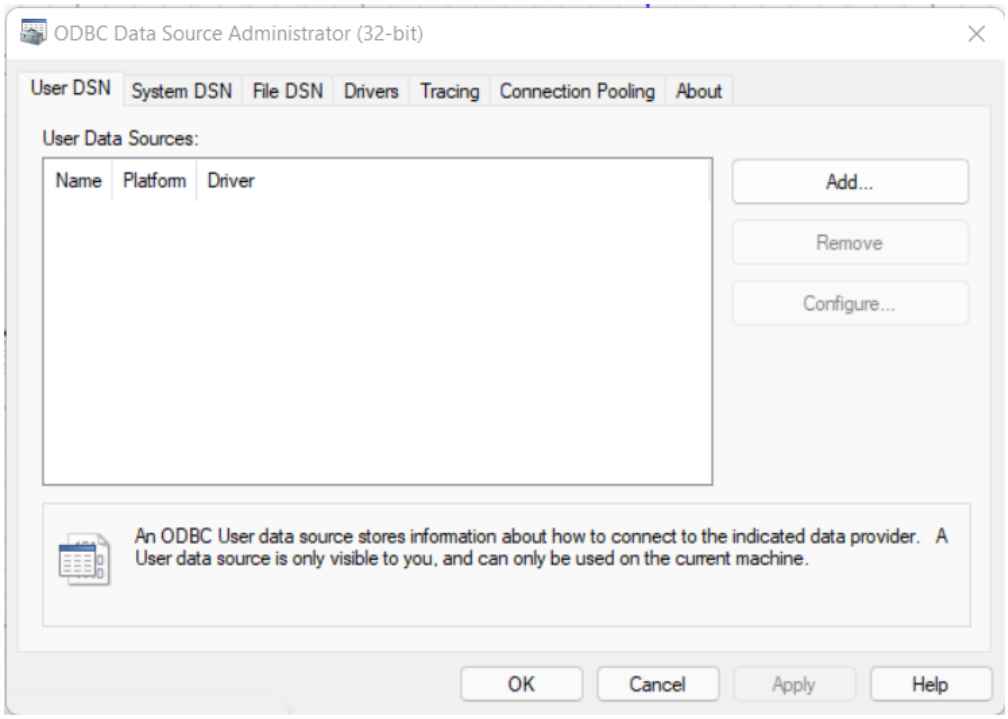
5. Locate the SQL Server Express Backup (SupplyChainWithOptimization.bak) file in your directory and select it. Select "OK."

6. Select "OK" again to return to the "Restore Database" window.



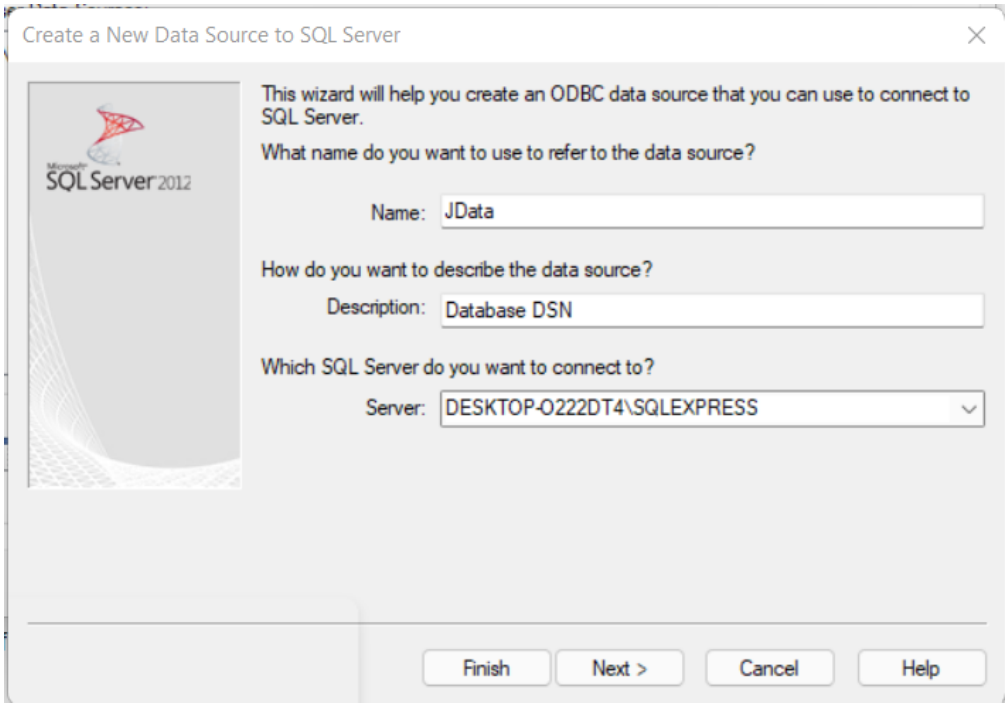
7. Select "OK."

For this model, we will be using a "User DSN" to allow Python to connect to the SQL Server Express database.



8. Open ODBC Data Source Administrator.

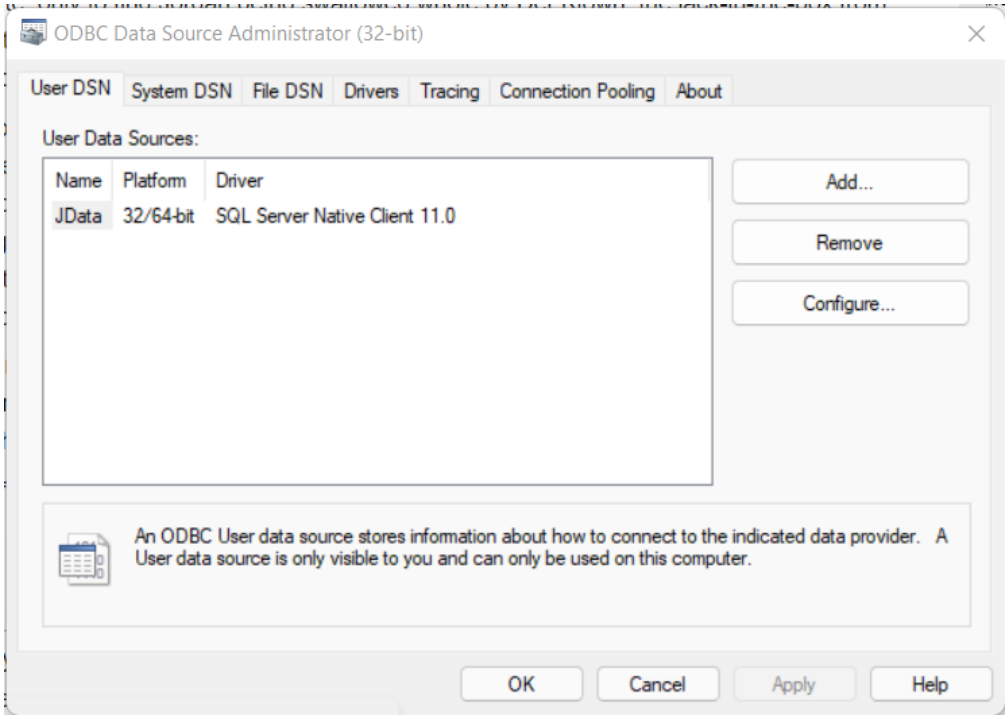
9. Select "Add."



10. Input the following values:

    - Name: JData
    - Description: Database DSN
    - Server: <SERVERNAME> (the name of your server installation)

11. Select "Finish."



Select "OK."

The SQL Server Express database and DSN connection is set-up.

Running the Model

1. Ensure all files are closed.
2. Place the Simio Model (SupplyChainWithOptimization.spfx) file and the Python Script (SupplyChainWithOptimization.py) in the same directory.
3. Open the Simio Model.
4. Run the Simio Model.